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Special Sahelian Office

THE RESPONSE OF PASTORAL NOMADS TO DROUGHT IN THE ABSENCE OF OUTSIDE INTERVENTION

Douglas L. Johnson **

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* The views expressed in the study are those of the author and do not necessarily reflect those of the United Nations.

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Western Africa is in the throes of one of the worst droughts that have gripped the area since 1913. All segments of society are to some degree affected, but the burden is distributed unequally among the region's various life styles. Although pastoral nomads possess a modus operandi specifically designed to cope with conditions that are too harsh and too marginal for most agriculturalists, prolonged drought has a devastating effect on nomadic life. Since pastoral nomadism represents a productive resource use system making important contributions to the economies of many underdeveloped or developing areas (Stauffer, 1965), an understanding of its typical behavior patterns and its ecological role in the semi-arid and arid regions of West Africa is essential to any program designed to bring both immediate and long-term relief to the present drought stricken region.

This paper is based on a review, whose major conclusions are summarized elsewhere (Johnson, 1969), of more than four hundred books and articles in the French, German, and English nomadic studies literature; this body of research deals with the ecological organization and migration patterns of pastoral nomadism in North Africa and Southwestern Asia. Understandings gained from this general review offer valuable insights into the nomadic response to drought, although the literature exhibits a general lack of interest in specific nomadic responses to extreme events. Of the case studies drawn on for the present statement, four, those considering the

Tuareg (both Saharan and Sahelian), Tibbu (of Chad's Tibesti and Borku regions), Reguibat Legouacem (and other Mauritanian pastoralists), and Kababish (from Kordofan province in the central Sudan), dwell within the regions most affected by the present drought. Recent field work among pastoral nomads in eastern Libya (Johnson, 1973) also provides a perspective for an analysis of drought-related events.

Most of the available literature dealing with pastoral nomadism discusses average environmental conditions and the successful, traditional, long-term livelihood systems adapted to them. Departures from normalcy, and changes in nomadic culture and practice resulting from such outside inputs as improved breeding stock, veterinarian services, well-drilling programs, rangeland management efforts, and alternative labor opportunities, receive scant attention. The impact these inputs may have on the changing abilities of pastoral nomads to cope with drought have not been considered in any detail. Moreover, adequate data on response to previous droughts are largely unavailable. This statement cannot completely overcome such inadequacies in the available data. However, this paper has been prepared on the assumption that those engaged in the tasks of assistance should understand the traditional modes of response to and recovery from drought. Specifically, it has the following objectives:
(1) to delineate the characteristics of the nomadic mode of livelihood that condition a response to drought; (2) to develop a generalized

model of pastoral response to drought; and (3) to suggest in broad outline major developments likely to occur within the nomadic community in the absence of major external intervention when presently adverse environmental conditions relax.

Pastoral nomadism as a cultural-ecological adaptation

From a climatological perspective drought is an integral part of the variable climatic regime of the Sahel for it occurs somewhere in the zone each year. In the perception of the nomad drought prevails whenever the normal seasonal alternation of wet and dry conditions is changed by: (1) an extention of the dry season beyond its usual term; or (2) a persistence of moisture deficit conditions through a series of years. The nomadic response to drought is intimately linked to two basic characteristics that are an integral part of nomadic organizat on and operation. Mobility and access to a multiplicity of resources, together with a set of intertwined, mutually reinforcing cultural and ecological devices, permit and encourage survival in harsh environmental conditions. These devices primarily focus upon animal husbandry and make available resources which cannot be used in most other socio-economic contexts. Five essential features, ecological rationality, movement, use of different animal species, minimum herd numbers for family unit support, and dependence on agricultural commodities, underlie the pastoral nomadic adaptation.

Pastoral nomadism must be seen as a livelihood system that is a rational response to a moisture deficient, fragile environment. Dwelling in a region characterized by low water availability, seasonal drought, and widely scattered seasonal fodder resources, nomads make use of resources that are beyond the reach of settled agricultural

populations. The systems of movement developed by nomads to use available resources cope well with seasonal average conditions. Alternating concentration around dry season wells, or other permanent water sources, and movement to seasonal pasture in another part of the tribal territory, constitute the basis of the adaptation. In this system human population, herd size, and grazing and water resources are maintained in rough balance. While pastoral adaptations are capable of dealing with most of the environmental fluctuations around mean conditions, extreme events are always devastating. In the face of prolonged drought very serious losses of animals may occur. The impact of the extreme event has been complicated in recent years by two major inputs from outside the traditional system. On the one hand the introduction of sophisticated technology in the form of well-drilling programs and animal vaccinations has frequently encouraged the traditional nomadic tendency to overstock rangeland; catastrophic losses during severe drought years are often the result. At the other extreme, the wider awareness generated by modern communication media and the economic benefits available in new, non-traditional employment opportunities alter the general conditions supporting the nomadic adaptation and encourage a drift of nomads into alternative activities. Nonetheless, revolutionary developments of this type, while obviously crucial to an understanding of the present state of the nomadic life style, should not obscure the essential ecological rationality of the nomadic pastoral regime.

The crucial feature of this ecological rationality is the nomadic concentration upon animals as the primary basis of the subsistence economy. This emphasis upon a mobile animal capital

reflects the highly variable set of resources available to nomads. These resources of grass and water seldom occur in conjunction either temporally or spatially in amounts adequate to ensure the survival of a nomad's herds over a long period. Thus, movement in a regular seasonal cycle is essential to balance pasture and water availability. Yet, as is indicated in Table 1, the distances involved in such movement can be highly variable. Moreover, a generalized classification of this type represents mean conditions and obscures the departures caused by extrere events. Thus most Tuareg in the central Sahara move their subsistence animals no more than 80 km. (Bognon, 1962), a distance similar to the 76 km. average movement noted for Fulani (Hopen, 1958) in the better watered savanna, although long distance movement of up to 500 km. does occur to avoid seasonal drought. On the other hand, Sahelian Tuareg normally migrate more than 800 km. in a seasonal round before returning in the dry season to their home region, an eliptically shaped zone roughly 50 km. in length (Nicolas, 1947). Nonetheless, restricted

TABLE 1

TRIBE	LENGTH OF DISPLACEMENT (in a seasonal round)		
	SHORT (150 km.)	MEDIUM (150-375 km.)	LONG (375 km.)
Ahaggar Tuareg	X		
Sahel Tuareg			X
Reguibat			X
Sahel Mauritania		X	
Tibbu (Tibesti)	X		
Tibbu (Borku)		X	
Fulani	X		

movement for all or part of the year in corporately owned tribal territories, with small subregions being linked to specific lower-level genealogical segments (Peters, 1960; 1967), is the typical pattern; longer distance patterns of migration reflect either seasonal or long-term severe deficits.

In an attempt to maximize the amount of resources that can be utilized by a group as well as to ensure that some animals will survive an environmental disaster, different animal species are herded. These animal species, in turn, have disparate physiological characteristics, possess different potentialities as exploiters of vegetation, and have varying resistences to drought. While they are roughly distributed in a latitudinal fashion ranging from camels in the arid north to cattle in the more humid south, considerable interpenetration of the zones to which they are adapted occurs and a mix of animals in any one area is most common. Yet the differential ability of each species to exploit the environment means that they must be herded separately, thus placing considerable strain upon family and kin structures to provide the labor force required to manage the herd. In addition, there is a minimum number of animals that must be maintained in a family's herd in order to support a nomadic life style. That some nomadic families are constantly being lost to pastoral nomadic society (either temporarily or permanently) as a result of declining herd sizes and consequent enforced sedentarization is a well understood feature of the nomadic way of life. For sheep and goat herders fifty (Barth, 1964) to one hundred (Johnson, 1973) animals per family are generally required to maintain a nomadic way of life, while fifteen to twenty camels usually suffice in more arid districts.

Among cattle herders, such as the Fulani, minimum herd size requirements are not mentioned in the literature. The picture is complicated because many Fulani also farm and this serves to reduce the size of herd needed; however, at the same time most prefer milk as the staple food throughout the year which necessitates an increased herd size. Popen (1958, p. 64) suggests an average herd size of thirty cattle for his sample population, but this is suggestive rather than definitive. In exceptional cases, where nomadic peoples rely on caravan trading or other activities to provide subsistence needs, smaller herd sizes may suffice. But as a rule to fall below minimal requirements for any length of time entails at least temporary abandonment of the nomadic life style.

Just as movement is essential to the nomad's survival, so too is agriculture. While traditionally nomads are conceived of as hostile to the practice of agriculture, recent studies suggest that they often will engage directly in agricultural operations (R. Dyson-Hudson, 1972). Where intimate and direct involvement in agriculture does not take place, an exchange of goods between nomads and farmers in the Sahelian zone is traditional (Mazoudier, 1945; Dupire, 1962). Similarly, the date groves of desert oases form fixed points in the nomadic migration patterns and provide vitally important dietary contributions to the nomads of more arid areas (Cauneille, 1950; Dubie, 1953; Toupet, 1963). Although sanctified as an independent and superior way of life by its own ideology, pastoral nomadism represents an unbalanced, specialized life style, particularly in those situations where the production of agricultural commodities is in the hands of other livelihood groups. Since ethnic and economic specialization is the common

method of livelihood organization in West Africa (Horowitz, 1972) pastoral nomads find themselves partially hostage to a risk-prone natural environment and to a potentially hostile sedentary population controlling resources essential to nomadic survival.

Reaction to the Extreme Environmental Event

Pastoral nomadism constitutes an adjustment to an anticipated set of long-term environmental and social conditions. Yet experience suggests that such average environmental settings are seldom encountered in any one year and that fluctuations of variable duration around this average are most common. This is particularly true for the intermediate zones between desert and savanna, where the opportunities to develop a multiplicity of resources are greatest but where the possibilities of disaster are equally profound. The present drought conditions in West Africa, prolonged and far-reaching though they are, represent merely an extreme manifestation of the variability inherent in an arid environment. Indeed, there is evidence that the present drought was preceeded by a series of wetter than normal years in which surface pools of water remained in existence throughout the dry season (Bernus, 1966, pp. 7-8). Similarly, just as Tuareg from the central Sahara drift southward into Niger during dry periods, so too do cattle herders move northward during wet periods; the presence of Fulani and their cattle as far north as the Air Massif has been reported by Nicolaisen (Nicolaisen, 1963, p. 23) and indicates that the present drought was preceeded by an era of moister than normal conditions.

Drought is a natural mechanism which reduces overstocking of range land. This overstocking and overgrazing is a direct result of the nomad's initial response to the threat of drought. This

initial response to drought, occurring during periods when drought does not exist but when its threat is an ornipresent future risk coloring all activities, can be regarded as "normalcy" (Table 2) for a nomadic group and can be viewed as the initial stage in a scenario of nomadic response to moisture deficit. Knowing from experience that dry years will inevitably occur, the nomad attempts to cope with the

TABLE 2. Nomadic Response to Drought: A Scenario

STAGE	CHARACTERISTIC RESPONSE OF NOMAD
AVERAGE CONDITIONS	
A. Wet Season	Maximum resource use periods; herds increase, capital accumulates; rainy season occasionally extends into dry part of year.
B. Dry Season	Dry season restrictions on resources, especially water; seasonal water holes abandoned; pressure on weakest and most vulnerable animal species and individuals and on herders with limited capital; pressure on grazing resources near available water; no sale of animals.
ABNORMAL CONDITIONS	
I. Deepening Drought	Extension of dry conditions into normally moister period; shallow water holes abandoned - concentration on deep water sources, oases, etc. Serious pasture constraints; great pressure on animals and herders; limited movement; raiding, some animal sales.
II. Intense Drought	Decision to migrate to distant pastures must be made; massive "die-offs" of water-demanding species during migration; capital constraints, depletion of seed stock; ability to sell animals hindered by poor stock condition.
III. Total Prolonged Drought	+90% of all herd animals may be sold, slaughtered, or dead. Reserve capital stock (rugs, jewelry, etc.) depleted. Involuntary sedentarization; survival threatened.
IV. Recovery	Use of capital reserves (jewelry, rugs, slaves, etc.) and/or the sale of labor to rebuild herds.

risk of potential future environmental disaster by increasing his herd to the maximum extent possible during rainfall surplus years. Movement to rainfall areas within a traditional seasonal range is characteristic, although the specific zones grazed varies considerably from year to year (Johnson, 1969). Judicious herd management emphasizing a maximization of herd size and a restriction of capital expenditures is practiced during every rainy season in anticipation of some loss during the subsequent dry season. The potential for herd increase is substantial, and under constant favorable conditions forty fertile ewes will increase in the space of sixteen years to a flock of 2400 even with 15% of the flock being sent to market each spring (Naderi, 1971). The destructive implication for grassland quality of such unchecked growth is obvious. Drought exacerbates the normal seasonal cycle of herd increase and decline; it reduces the herd's expansion potential during the foreshortened rainy season, while whittling away the herd at an accelerated rate during the dry period.

Thus, prolonged drought acts as an impediment to long-term unlimited growth of herd size and brings herd numbers and pasture resources into rough balance. It is the drastic reduction in herd size resulting from extended drought that permits the recovery of over-utilized pastures and prepares a fragile ecosystem for the renewed expansion of the animal population that follows a return to more average conditions. Drought is not the only limiting factor, for animal diseases, of which the 1887-91 rinderpest epidemic reported by Hopen is a good example (Hopen, 1958, p. 16), can produce equally spectacular reductions in herd size.

During average conditions nomads experience drought seasonally when the dry season begins. The pressures represented by desiccating vegetation are experienced by nomads each year. In all cases the response is typical; seasonal water sources, usually surface pools of rainwater, are abandoned and the herds are shifted to the tribe's permanent watering points. As aridity increases, the need to water stock frequently increases pressure on both available water and pasture resources adjacent to wells and upon animals and herders themselves. The weakest and most vulnerable individuals and species may reach a mortality stresspoint and those herders with limited capital resources and minimal herd size experience particular pressure. For nomads existing at the margin of subsistence, normal seasonal pressures become too great, capital reserves and herd stocks fall too low, and involuntary sedentarization or employment as hired shepherds become the inevitable result.

Stage I in the nomadic response to drought occurs when moisture conditions fail to reappear with their expected seasonal regularity. Less reliable water sources are gradually abandoned and concentration on a restricted array of permanent deep-water wells take place (Prenaud and Pagot, 1962.) The result is to concentrate a larger number of animals and herders in increasingly restricted areas within tribal homelands. The situation becomes even more acute when the restricted movement focuses on agricultural areas; where such resources are in the hands of an <u>in situ</u> sedentary population, high rents for limited pasture and water are charged. Obligations to assist needy kin add another dimension to the struggle for access to scarce resources and gross overcrowding can take place. In one case in the Negev, 1200 sheep were pastured in 75 acres of rented land (Marx, 1962, p. 211).

Suprisingly, in conditions of deepening drought the pressure situation frequently encourages restricted movement rather than abrupt departures for distant areas. This inhibition against long-distance movement is often ascribed to "Islamic fatalism", but in fact is based on quite rational motives. Because nomads possess a detailed understanding of local pasture and water resources, there is a reluctance to move to zones where their local knowledge is less intimate (Nicolaisen, 1963, p. 131f). Not only are opportunities for access to resources external to the tribal territory only partially perceived, but also movement to alternative zones is invariably accompanied by high herd losses. Also there is fear that continuation of drought conditions may make a return to the tribal homeland difficult, if not impossible, for a considerable period of time.

Under these conditions, the concentration upon diminishing water supplies p aces increased pressure upon a reduced area of pasture. The ul imate result of this downward spiral, if drought continues, is the decimation or elimination of entire herds beginning with the weaker and less resistant individuals and species. At this time raiding to augment resources may take place. Traditionally nomads used the power potential inherent in their mobility to seize by force resources necessary for survival. Although raiding is an integral part of bedouin culture (Sweet, 1965), its operation is restricted today. The peace-keeping activities of colonial authorities and the contemporary acquisition of modern military technology by indigenous sedentary groups has changed the nomad-sedentary power balance and eliminated the possibility that nomads can take their requirements by force. From a position of dominance, the nomad has declined to the status of a beggar, a dependent on the charity of

settled folk for survival in conditions of extreme drought.

It is important to note that this process replicates the normal patterns and problems of concentration around permanent dry season water facilities (Asad, 1970), although in exacerbated form. As a consequence, the initial response of restricted mobility constitutes a short-term risk minimization policy predicated upon short-term departures from average conditions. The danger inherent in being caught in such a posture, should conditions prove more extreme than expected, is considerable. Trapped by widespread, prolonged drought, the nomad may be unable to shift to an alternative response and may be condemned to watch first his herd and then his kin die.

Given an expectation that severe drought will continue for a considerable period (Stage II), a decision to move herds and family to other, hopefully drought-free, areas may be taken. Generally, these movements are toward the edges of recognized tribal territory (Canneille, 1950) and it is usually at these times that conflict situations develop between pastoral groups for access to pasture. Movement of this type is usually in a direction and to a region that is familiar to the nomad, although its length and duration may be greater than the average seasonal cycle. As such, these movements represent a flexible response to the variability inherent in the nomad's habitat (Johnson, 1969), and are usually made to areas with which the nomad has experience. Herds may be split with the more vulnerable species moved to new locations in the expectation that their survivability may be enhanced, while durable subsistence animals remain behind. This is particularly true for nomads who herd a number of animal species, often in widely dispersed areas. Alternatively, migration of entire tribal components may take place. Under extreme

conditions, albeit with great reluctance, the Ahagger Tuareg, for example, move their household goat herds as much as 500 km. to join their camel herds which usually reside in the Tamesna region of Niger (Rognon, 1963). An equally common practice among nomads either practicing agriculture or returning to an oasis at some fixed point in their migration cycle is to move to the agricultural area and hope to wait out adverse conditions (Canneille, 1950) near permanent water sources. This may avoid complications with other nomadic tribes but it is certain to cause difficulties with the local agricultural population.

When all else fails, the nomad abandons his life style, at least temporarily (Stage III). Surviving stock may be sold, if a market can be found, or slaughtered for domestic consumption. Attempts to sell animals during this period are hampered by the poor condition of the livestock and the financial returns of such sales never approach the value of the animals under normal circumstances. Loss of stock frequently exceeds 90% (Hopen, 1958; Johnson, 1973), the descent to poverty is abrupt, and the rate of recovery slow, arduous, and uncertain. Rugs, jewelry, and other hoarded capital resources are expended only with great reluctance, and alternative employment sought, in an attempt to preserve enough capital to permit purchase of animals and rebuilding of herds when conditions change.

This process of sedentarization is always viewed as a temporary expedient, but it is essential to realize that it is an integral part of nomadic society. Rich and poor are continuously sloughed off from nomadic society (Barth, 1964; Stenning, 1957, 1959). While many wealthy nomads may visualize settlement on or

near property purchased with the proceeds of their herds as permanent, among the poor the expectation is that nomadic life will be resumed as soon as capital and environmental conditions permit. Again, prolonged drought may exacerbate, accelerate, and in some cases make permanent, normal tendencies, but it represents a difference in degree rather than in kind.

Post-Drought Recovery

Once environmental conditions ameliorate, there is every reason to assume, except in those areas where settlement has become permanent, that nomads will want to resume their former way of life. In 1914, at the end of the last Sahel-wide drought and before the full effects of European colonial intervention upon indigenous systems became apparent, traditional patterns of recovery, now only vaguely understood and remembered, would have taken place. Today pastoral nomadism has been placed under very considerable stress as a result of changing socio-economic conditions. These stresses constrain the ability of a life style already under pressure to generate recovery from drought by means of its own resources. Indeed, the planning initiatives of central governments are likely to encourage settlement of the drought-impoverished nomadic community south of its traditional areas in regions deemed more stable and less prone to environmental risk. It is likely that such policies will conflict with existing pastoral desires and result in the occurrence of a conflict situation when the normal recovery drives inherent in pastoral nomadism begin to operate.

The first and most powerful recovery drive will be the desire to resume pastoral migrations. However, since most

nomadic stock will have been destroyed by the drought, and since for many nomads available capital reserves will have been drastically depleted, only a limited number of pastoralists will be able to resume a nomadic life style based on their own resources. This will create demands for governmental assistance. These pressures for assistance should be heeded, but the approach should be a cautious one. Overly rapid restocking must be avoided; the emphasis should be on introducing higher quality stock with a tolerance of local conditions equal or superior to that of the lost populations. Despite anticipatable nomadic pressure for rapid expansion of herd size, sufficient time for pasture regeneration, as would occur during the slow herd rebuilding process characteristic of the traditional nomadic regime, should be permitted. Similarly, excessively zealous expansion of watering facilities as a hedge against anticipated future droughts should be avoided until rangeland regeneration and adequate assessment of long-term support capacity has taken place. Otherwise too rapid response to the nomad's demands for recovery assistance may well result in permanent degradation of the area. Grass conditions not water needs should be the major determinant supplies.

A corollary of the desire to resume migration is the expectable attempt to return to home territories on the part of those nomads who are capable of doing so. The pressure to do so will be intense. All groups forced by the drought to migrate outside their traditional range will be existing in those areas on sufferance. The long-term right to use those resources will be vested in other groups. Thus the pull of home territories, indis-

putably their possession, plus the push of other corporate bodies, be they nomadic or agricultural, should generate great pressures for a return to familiar territories. This impulse should be encouraged. For not only do nomads know the resources of their own areas in painstaking detail, but also there is little likelihood of other groups being able to or desirous of using those resources. Thus the use of marginal resources by a mobile pastoral life style enhances overall economic productivity. Permanent collapse of pastoral nomadism may well mean a reduction in the quantity of animal products available, a loss of resource base undesirable in countries striving to generate economic growth. Although it can be argued that the nomad's reluctance to sell his stock reduces his importance to economic development and capital formation, modest structural rearrangements in tax policy and collection efficiency can be utilized to enhance pastoralism's contribution to national goals. The death of a way of life by either neglect or conscious policy precludes this possibility.

The recovery period is also likely to be characterized by considerable social unrest which will increase in severity in proportion to the length of the drought. Many of these strains will be present within the nomadic milieu itself. Because the wealthiest members of nomadic society have the largest herds, their chances of retaining some stock are enhanced. This gives them a decided advantage when recovery becomes possible. Those individuals with either capital or stock will find themselves in a powerful position and the extent of their control over the behavior of their fellow tribesmen will be extended. Under normal circumstances ties of kinship and marriage are activated to enable an individual to derive

assistance from within one's corporate group. During extremely widespread catastrophic events this help may no longer be available. The result may be a setting of hostility and tension within the nomadic community as traditional relationships degenerate and new, and perhaps undesirably counter-productive, patterns of obligation, debt, and clientship emerge.

Just as tensions are likely to develop within nomadic society, so too is hostility toward local governments possible. Pastoral nomads have always required support from agricultural society in order to remain viable. In the past, this assistance could be extracted by force, but today government sponsored agricultural expansion has removed many former pasture areas from use for animal husbandry while modern military technology has conferred decisive advantages upon sedentary society. Restricted to the most marginal areas agriculturally, nomadism occupies an increasingly fragile and delicate position. The consequences of drought are exacerbated by the increasingly tenuous resource base remaining available for exploitation. This pressure situation is ideally suited to the generation of anti-governmental feelings. In many cases, these are intensified by ethnic differences. Governmental support is usually drawn from the sedentary portion of the population, and pressure from the nomadic community for assistance is likely to be drowned by the demands of agriculturalists for priority in the allocation of scarce aid resources. In many instances traditional hostility between nomad and farmer (although frequently overemphasized) has already resulted in active hostilities, and in these situations relief for nomads will

be ignored or actively discouraged. Generally, the consequence of such circumstances will be the demise of the nomad and his unwilling stabilization in place or his search for new opportunities elsewhere.

Given that pastoral nomadism is an ecologically rational resource use system, there are a number of focal points in the system where limited amounts of aid would enhance the overall efficiency of pastoralism and speed its long-term recovery. Attention should be paid to selectively introducing modern technology into the migration cycle. Increased use of trucks to shift herders and their animals to wet season pasture would insure that distant forage resources could be reached quickly and efficiently. Possession of trucks would also insure that herds could be moved rapidly away from water-deficient areas with only minimal loss as well as improve the ease of reaching market centers. Considerable steps in this direction have occured in Libya without government sponsorship since the discovery of oil. It is not difficult to envision the Land Rover or Jeep replacing the camel in tribal migration, while short wave radio communications between trucks and a central base improve traditional information distribution systems that bring herds, grass, and water into contact.

Sedentarized ranching in particularly favorable regions might be a solution. Although this fails to make creative use of the special genius of nomadism, its use of mobility to reach otherwise inaccessible resources, it does salvage stockraising skills that would be lost if a shift to other occupations or migration to urban areas became the dominant feature of the recovery period. More suitable would be the provision of guarantees to the nomadic community that would serve to protect it against the risk of future

drought. Since lack of pasture is as likely to cause animal mortality as is the absence of water, the stockpiling of animal fodder in the dry season areas of the tribal homeland is probably more important than the drilling of new well facilities. Increased specialization on particular animal species would improve efficiency. Rather than having to herd a number of different animals as a hedge against drought, concentration of effort on the most productive species seems desirable. However, this would require a willingness on the part of local governments to provide firm guarantees of insurance capital to enable recovery to take place if disaster should strike.

Similarly, the nomad's tendency to increase herds to the maximum size possible could be controlled by a judicious combination of taxation designed to encourage the sale of animals to preserve rangeland management balance plus guarantees that smaller herd sizes would not place the nomad in an untenable long-term position. Finally, more specialized nomadic livestock operations that reduce the diversity of the subsistence economy will increase the nomad's dependence on the sedentary community for agricultural goods and may make special provisions necessary.

Admittedly many of these suggestions for possible adaptive response by and redirection of pastoral nomadism would be difficult to attain. The spontaneous integration of the Land Rover into the pastoral culture of eastern Libya is an extraordinary response to the abrupt discovery and rapid development of an unusually rich fossil fuel resource. Given the limited prospects for sudden infusions of locally generated capital in the impoverished Sahelian states, the broad-scale application of technological fixes is un-

likely. On the other hand, the use of relatively simple taxation devices to encourage the sale of herd animals has been employed successfully in the Sudan; good results in terms of generating capital to meet national goals and reducing overgrazing problems have been reported and these techniques could be extended to other areas. However, one of the major issues in assisting the recovery effort remains the difficult task of identifying those critical foci where limited investments will yield maximum improvements at the grass roots level.

In the absence of palliative short-term relief assistance and of creative programs for long-term adaptation, the prospect for nomadic recovery following the end of the present drought is not good. With herds destroyed, capital depleted and normal internal patters of self-help inoperative, the conditions for the long-term survival of pastoral nomadism are lacking. Already under great stress as a result of changing political, cultural, and social arrangements, pastoral nomadism may well be dealt a coup de grace by the present drought. In the absence of intervention, reconstitution of the nomadic way of life by all but a remnant is unlikely. The result will be the loss of a marginal ecological niche that can only be exploited by a pastoral way of life.

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